

Section 6: Monitoring and Adaptive Management of MPAs

The MLPA requires adaptive management to ensure that a system of MPAs meets its stated goals [Section 2853 (c) (3)]. The MLPA defines adaptive management as “a management policy that seeks to improve management of biological resources, particularly in areas of scientific uncertainty, by viewing program actions as tools for learning. Actions shall be designed so that, even if they fail, they will provide useful information for future actions, and monitoring and evaluation shall be emphasized so that the interaction of different elements within marine systems may be better understood” (Section 2852 (a)). Adaptive management requires learning from current experience to improve the process of achieving the goals of the MLPA over time. The law embeds ecosystem-based adaptive management, monitoring, and evaluation into the state policies related to the management of MPAs.

This approach will require the State to develop and implement a monitoring, evaluation, and adaptive management program. The State must also develop the institutions and processes for adaptive management which do not yet exist. Two such examples are the institutions and processes by which monitoring data are collected, maintained and made useful to policy makers over long periods of time and those required to assess this information, including involvement of scientists and stakeholders and formulate recommendations to policy makers. Adaptive management, monitoring, and evaluation will be implemented at multiple spatial scales, including individual MPA, MPA networks in a region, and statewide when appropriate.

It is worth noting that the MLPA calls for monitoring and evaluation of selected areas within the preferred alternative to assist with adaptive management of the MPA network. This does not mean that other MPAs should not also be monitored and evaluated in accordance with their own objectives and regional goals, but that the performance of selected MPAs might be used to guide future decisions over a wider area.

Monitoring and evaluation should not be done for their own sake, but to gauge the performance of an MPA in relation to its objectives. A cost effective approach in many areas may be to link these activities to other ongoing monitoring activities. Similarly there may be many opportunities to involve affected stakeholders and members of the general public in monitoring and evaluation activities as well, thus leveraging further the resources available.

An important part of marine ecosystem management is the establishment of programs to monitor, evaluate performance, and adaptively manage the biological, social, and economic status and trends of areas within and nearby the MPAs. This chapter develops a general approach to these issues and Chapter 8 includes specifics for individual MPA network components. Long-term monitoring data are critical for understanding the status and trends of resources and identifying emerging threats to MPAs. The data will help managers, policymakers, scientists, and stakeholders determine the impacts and effectiveness of the MPA array. Data will be used to evaluate the progress towards achieving the statewide goals, regional goals and objectives, and objectives for individual MPAs established by the MLPA and by the regional stakeholder groups. They will aid in understanding the structure and function of ecosystems within the MPA system, and thereby provide an improved scientific basis for future decision-making. These data will be used for adaptive management of the MPAs.

Since MPAs will be implemented in a phased approach in individual regions through 2011, rather than adopted all at once statewide, the monitoring programs will be developed sequentially as planning is completed for each region. Nevertheless, integrating these regional monitoring programs into a coherent statewide program will be essential to ensure the resulting data can be analyzed, reported, and used to inform statewide policies. Significant economies of scale also will result if standardized methods are applied across multiple locations and regions. Early consideration should be given to how the regional monitoring programs will be integrated into the statewide system, because such integration is likely to require development of general practices – such as protocols, data standards, and information management systems – that can be applied across multiple MPAs and regions.

Clear and measurable objectives should form the basis for the design of systems to monitor and evaluate the impacts of management actions. Monitoring and evaluation systems should explicitly address five principles (Pomeroy et al. 2004). Such programs should be:

- Useful to managers and stakeholders for improving MPA management;
- Practical in use and cost;
- Balanced to seek and include scientific input and public participation;
- Flexible for use at different sites and in varying conditions; and
- Holistic through a focus on both natural and human perspectives.

Developing a Monitoring and Evaluation Program for MPAs and Network Components

To promote consistency among monitoring and evaluation programs in different regions, a consistent process should be followed. Many of the recommendations below are modified from a 2004 guidebook to natural and social indicators for evaluating MPA management effectiveness (Pomeroy et al. 2004). This discussion relies heavily on the guidebook because it is comprehensive, reflects the experience from MPAs around the world, has been field tested, and relies principally upon techniques that are simple rather than complex, and therefore more likely to be implemented and sustained over the long-term. The overall intent is to ensure that progress is made to achieve the overall Goals of the MLPA. Individual MPA objectives are important in this, but should be linked to the program goals for use in evaluation.

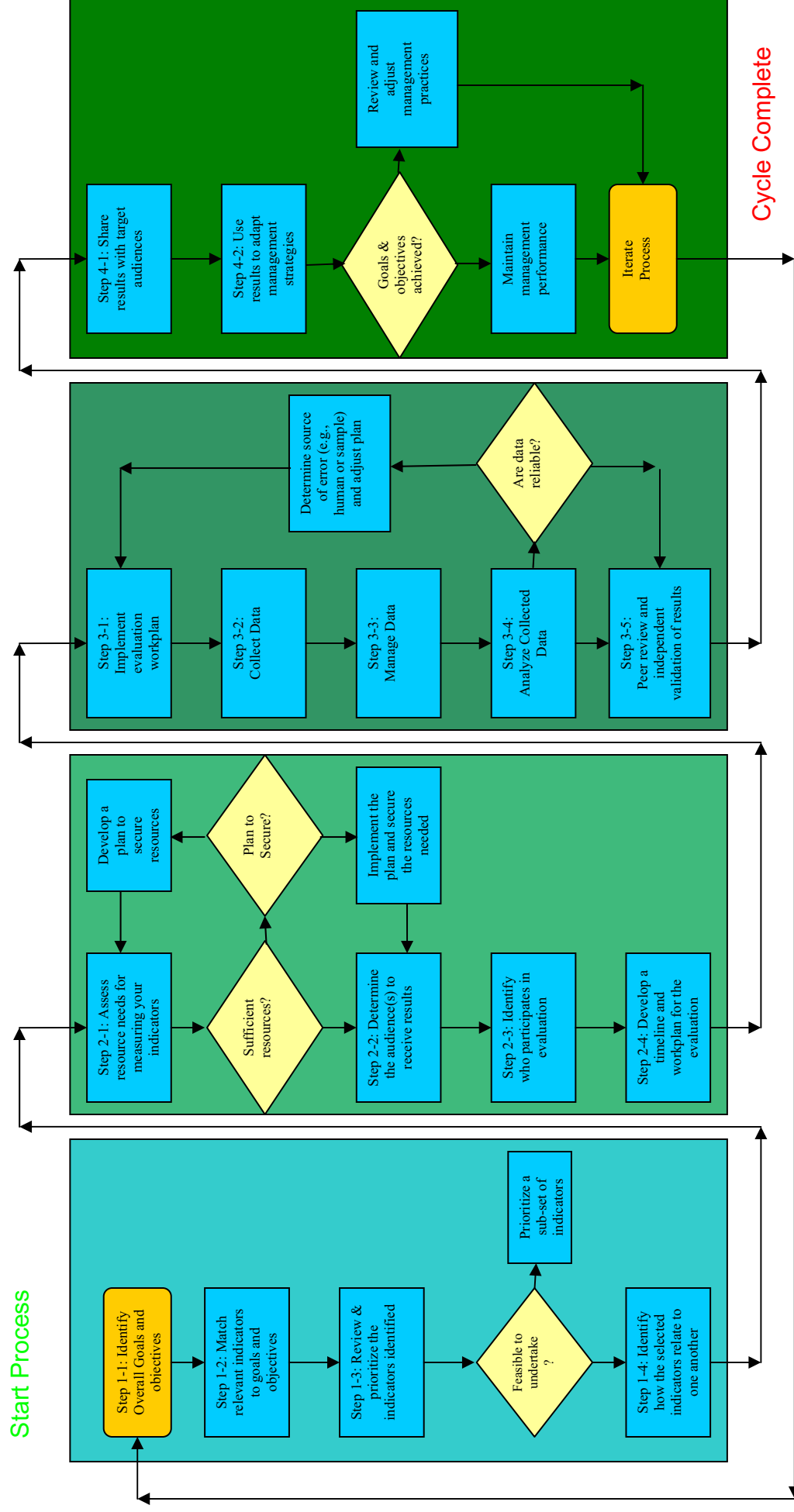
The process below presents only the more general features of the approach presented by Pomeroy et al.; much more detail is available in the guidebook itself. In addition, monitoring and evaluation programs should reflect local conditions, constraints and opportunities. The basic steps for establishing a monitoring program are listed below and displayed in a flowchart in Figure 5.

- Identify regional goals and objectives and individual MPA objectives
 - Identify any overlapping goals and objectives
- Select indicators to evaluate biophysical and socioeconomic patterns and processes
 - Review and prioritize indicators,
 - Develop quantifiable benchmarks of progress on indicators that will measure progress toward regional goals and objectives and individual MPA objectives, and
 - Identify how selected indicators and benchmarks relate to one another

- Plan the evaluation
 - Assess existing data;
 - Assess resource needs for measuring selected indicators;
 - Determine the audiences to receive the evaluation results;
 - Review relevant monitoring and evaluation programs at existing MPAs, such as at the Channel Islands;
 - Identify participants in the evaluation; and
 - Develop a timeline and work plan for the evaluation.
- Review and revise planned monitoring and evaluation program
 - Conduct structured peer and public review processes, and
 - Make modifications in response to review
- Implement the evaluation work plan
 - Select methods and approach and collect data;
 - Manage collected data (including identifying the data manager, providing for the long-term archiving and access to the data, and making the data available for analysis and sharing);
 - Analyze collected data; and
 - Conduct peer review and independent evaluation to ensure robustness and credibility of results
- Communicate results and adapt management
 - Share results with target audiences, and
 - Use results to adapt management strategies

Indicators of success include those pertaining to biophysical and socioeconomic goals and objectives. Examples include, among many others, focal species abundance to determine whether resources are being sustained and human use levels to determine if desired enhancement of recreational, research, and other non-consumptive opportunities is occurring. Pomeroy et al. list a total of 42 indicators (10 biophysical, 16 socioeconomic, and 16 governance) that cover combinations of 21 commonly used MPA goals and 68 commonly used objectives. The guidebook essentially provides a “toolbox” of indicators and a starting point for developing a plan. It also provides some detail on survey methods used to measure the indicators, though is not a comprehensive listing of all survey methodologies. Once regional goals and objectives are selected and individual MPA objectives determined, the guidebook and following flowchart (Figure 5) will help provide a method to establish monitoring programs.

Figure 5. Flowchart of process to establish and conduct a monitoring program¹².



¹² Adapted from Pomeroy, et al., 2004.

To achieve the purpose of informing adaptive management, the results of monitoring and evaluation must be communicated to decision makers and the public in terms that they can understand and act upon (NRC 1990). Moreover, in addition to aiding in MPA management, measuring, analyzing and communicating indicators can promote learning, sharing of knowledge and better understanding of MPA natural and social systems among scientists, resource managers, stakeholders, members of the public, and other interested parties (Pomeroy et al. 2004). To these ends, monitoring and evaluation programs for MPAs should include a communications plan that identifies the target audiences and specifies the timing, methods, and resources to regularly synthesize and present monitoring and evaluation results.

Though the results from ongoing monitoring and evaluation should be reviewed periodically, a comprehensive analysis of monitoring results should be conducted approximately every five years. The longer time-frame for review takes into account the fact that biological changes are slow to occur. Some trends are more likely to become apparent on this time scale, although others may take longer to emerge. These reviews should be transparent, include peer review, and make results available to the public. Besides evaluating monitoring methods and results, the review should evaluate whether or not the monitoring results are consistent with the objectives of the individual MPA, the goals and objectives of the region, and those of the MLPA. If the results are not consistent, the review should develop recommendations for adjustments in the management of the MPA network.

Within the above set of required components, specific monitoring methods are not prescribed, although, as mentioned previously, some alignment of regional and statewide approaches will be desired. For example, monitoring and evaluation programs may be effective within a range of levels in intensity and sampling frequencies. They also may rely on different indicators, depending on the individual and regional MPA goals and objectives.

General Considerations in Identifying Indicators

An indicator measures the success of a management action, such as the specific design of an MPA. It is a unit of information measured over time that will make it possible to document changes in specific attributes of the MPA (Pomeroy et al. 2004). General considerations in selecting or designing an indicator include:

- Measurable - able to be recorded and analyzed in quantitative or qualitative terms.
- Precise - clear meaning, with any differences in meaning well understood OR measured the same way by different people.
- Consistent - not changing over time, but always measuring the same thing.
- Sensitive - changing proportionately in response to actual changes in the variables measured.
- Simple - rather than complex.
- Independence defined - correlation with other indicators examined.

In selecting indicators, a monitoring and evaluation plan for a portion of the MPA network should (Pomeroy et al. 2004):

- Define and provide a brief description of the indicator;

- Explain the purpose and rationale for measuring the indicator;
- Consider difficulty and utility—that is, how difficult it is to measure and the relative usefulness of information provided by the indicator;
- Evaluate the required resources including people, equipment, and funding;
- Specify the method and approach to collecting, analyzing, and how the sampling design addresses issues of spatial and temporal variation;
- Identify reference points or benchmarks against which results will be measured and timelines within which changes are expected;
- Explain how results from measuring the indicator can be used to better understand and adaptively manage the program;
- Provide references on methods and previous uses of the indicator.

Prior knowledge of the variability in the indicators selected should be incorporated into the monitoring and evaluation design where possible. If no prior knowledge exists variation in indicators must be identified within the monitoring and evaluation program. Multiple independent indicators are required for complex systems such as in the marine environment. Consideration also should be given to the timescale within which changes in an indicator might reasonably be expected. For instance, recovery of populations of long-lived species, such as some rockfishes, may require many years; performance measures or other types of benchmarks for such indicators should reflect this longer timescale.

Monitoring and evaluation programs should measure at a minimum biophysical and socioeconomic indicators, since these dimensions of marine ecosystems are inextricably linked (Pomeroy et al. 2004). Possible indicators are described below.

Biophysical. One common focus of MPA programs is the conservation of living marine resources and habitats of California's coastal waters. Likely biophysical goals established under the MLPA include sustaining the abundance and diversity of marine wildlife, protecting vulnerable species and habitats, and restoring depleted populations and degraded habitats. Thus, potential biophysical indicators might include (Pomeroy et al. 2004):

- Abundance and population structure of species of high ecological or human use value;
- Composition and structure of a community of organisms;
- Survival of young;
- Measures of ecosystem condition;
- Type and level of return on fishing effort;
- Water quality; and
- Areas whose habitat or wildlife populations are showing signs of recovery.

Socioeconomic. Socioeconomic indicators make it possible to understand and incorporate the concerns and interests of stakeholders, to determine the impacts of management measures on stakeholders, and to document the uses and values of the program for the public and to decision makers (Pomeroy et al. 2004).

Examples of possible socioeconomic indicators consistent with MLPA goals include:

- Use data (and values of those uses) for consumptive and non-consumptive purposes, including:
 - Numbers of participants
 - Measures of economic and perceived value and level of satisfaction derived from allowed consumptive and non-consumptive activities
 - Changes in geographic and other patterns of use in and around MPAs within the region;
- Effects of allowed human uses on MPA resources;
- Volunteer and community engagement in MPA-related monitoring and education;
- Shareholder knowledge of natural history and current use patterns and intensity.

All of these indicators would be tailored and specifically defined to reflect the conditions, resources present, use patterns and goals and objectives of each MPA or region.

In addition, it is important to recognize the role that volunteer monitoring activities can play in evaluation. As mentioned earlier, there may be many opportunities to leverage with existing monitoring activities in the region and to make very productive use of stakeholder, other members of the public and educational and research entities to form partnerships in conducting monitoring and management programs. For example, the Citizen Watershed Monitoring Network in the Monterey Bay National Marine Sanctuary has used a monitoring protocol developed by the U.S. Environmental Protection Agency in collecting information on water quality in the sanctuary. Information from this program has helped in determining where education and outreach efforts should be targeted, in determining how successful specific pollution reduction activities have been, and in identifying problem areas for further investigation.

Finally, monitoring and evaluation programs can benefit from engaging commercial and recreational fishermen. At the Channel Islands, in Morro Bay, Fort Bragg, and elsewhere along the California coast, fishermen, research scientists, and federal and state biologists are carrying out field projects of mutual interest, including tag-and-recapture studies that provide critical information on the movement of fish and their growth rates. Similarly, recreational fishermen have recently participated in collecting information on their catches as part of the Coastside Fishing Club's Recreational Catch Estimation Project. The Channel Islands National Marine Sanctuary Foundation supports a Cooperative Marine Research Program which helps coordinate and fund fisheries/science cooperative monitoring projects. These initiatives are in the early stages of development, and offer important opportunities for collaboration.